

Optimization Problems

p. 306 - 311 (4.6)

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Optimization means to maximize or minimize a quantity or situation.

To optimize, find the max or min and apply that amount to the particular situation.

** (FR) 1. A ball is thrown from the origin of a coordinate

system. The equation of its path is $y = mx - \frac{e^{2m}}{1000}x^2$,

where m is positive and represents the slope of the path of the ball at the origin. For what value of m will the ball strike the horizontal axis at the greatest distance from the origin? Justify your answer.

$$y = mx - \frac{e^{2m}}{1000}x^2 = 0$$

$$x\left(m - \frac{e^{2m}}{1000}x\right) = 0$$

$$x = \frac{1000m}{e^{2m}} \quad \left[\begin{array}{l} \text{greatest} \\ \text{distance} \end{array} \right] \rightarrow \text{find } x'$$

$$\begin{aligned} x' &= \frac{e^{2m}(1000) - 1000(m)(2e^{2m})}{(e^{2m})^2} \\ &= \frac{1000e^{2m}(1 - 2m)}{(e^{2m})^2} = 0 \quad m = \frac{1}{2} \end{aligned}$$

$$\begin{array}{c} + \quad | \quad - \\ \rightarrow \quad \frac{1}{2} \quad \downarrow \end{array}$$

** (calc.) 2. If $y = 2x - 8$, what is the minimum value of the product xy ? -8

$$P = xy$$

$$P = x(2x - 8)$$

$$P = 2x^2 - 8x$$

$$P' = 4x - 8 = 0$$

$$4x = 8$$

$$x = 2$$

$$P' \quad \begin{array}{c} - \quad | \quad + \\ \hline 2 \end{array}$$

$$x = 2$$

$$\begin{aligned} y &= 2(2) - 8 \\ &= 4 - 8 = -4 \end{aligned}$$

$$P = (2)(-4) = -8$$

the max because x' changes from (+) to (-) there.